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Capacity-building, education and public awareness, science and transfer of environmentally sound technology

(Chapters 34-37 of Agenda 21)

Report of the Secretary-General

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I. Introduction

1. The present report consists of brief summary reports prepared on four separate chapters of Agenda 21 by their respective task managers.[1] It has been prepared in response to the decision of the General Assembly at its nineteenth special session, in 1997, to include in the multi-year programme of work of the Commission on Sustainable Development capacity-building, education and awareness-raising, science, and transfer of technology as a cross-sectoral theme for consideration by the Commission in 1998. Each section of the report provides a brief status update and a series of proposals for further action. In addition, more detailed information is provided in addenda to the present report or in background papers made available by the task managers. This additional information is referred to in the relevant section of the report.

II. Cooperation for capacity-building: chapter 37 of Agenda 21*

A. Capacity-building for sustainable development: the state of the art

2. As task manager, the United Nations Development Programme (UNDP), submitted its first report on capacity-building in 1993, followed by updates in 1995, 1996 and 1997. Its current report has two main themes. First, the cautious optimism evident in the 1997 report continues. Although enormous constraints to the achievement of effective capacities to promote sustainable development remain, genuine signs of progress are evident. Moreover, such signs can be seen across the globe from small countries such as Burkina Faso to large ones such as China and from low-income countries such as Bolivia to middle-income ones such as Morocco. It now seems apparent that people can make progress on capacity-building towards more sustainable livelihoods wherever they live, providing they receive support and encouragement. Second, this report gives greater attention to issues of implementation and action. At present, most countries have strategies for either environmental management or sustainable development, and the global community has a reasonable sense of what needs to be done with respect to capacity-building for sustainable development. The main challenge now lies in implementation – learning to use capacities that already exist, developing new ones and building the trust, incentives and willingness to collaborate.

3. The main trends that have emerged in capacity-building in the past several years are summarized below. The emphasis here is on the structures, ideas, values and behaviour that encourage implementation of the many strategies, including national sustainable development strategies, national environmental action plans and national conservation strategies that have been formulated over the past decade:

(a) There has been a decline of "command and control" approaches by state agencies in the public sector. There is much greater recognition that resource protection policies enforced by central agencies have, in many cases, led to local resistance, dysfunctional incentives and unsatisfactory service levels;

(b) A more decentralized approach to resource management has emerged, which relies upon less proscription and more responsiveness to the actual social and economic context of people's livelihoods;

(c) There has been an increase in partnerships and multi-agency networks among public agencies, non-governmental organizations, community groups and private profit firms. Such arrangements are an attempt to provide the collaboration and coordination that has proved extremely difficult to achieve under the old centralized hierarchical arrangements;

(d) There is now greater use of market-based incentives, including changes in resource pricing, tax policy and revenue distribution;

(e) There is a trend to much greater participation and citizen empowerment through different organizational arrangements, education and awareness campaigns and greater democratization. The impetus for capacity development is becoming as much demand-led as supply-driven;

(f) There is a greater involvement of local and municipal governments and their ability to provide integration at the micro level is increasing;

(g) There is a much greater willingness to experiment with new approaches to capacity development and to consciously learn from experience. This shift includes getting access to global learning through electronic networks.

4. Elements of this package of reforms can be seen in many countries. The challenge now is to combine this complex policy and organizational mix at the local, national

* Additional information is provided in a background document circulated separately by the task manager.

and international levels into a critical mass that can lead to significant changes in human behaviour.

B. Relationship to sustainable development planning

5. Most countries remain at an early stage of trying to achieve a more coordinated approach to sustainable development planning. Some of the more promising approaches are the following:

(a) Most countries have focused their capacity efforts with respect to sustainable development on environmental issues, with the intention of including sectors involving education, population, industry, tourism, energy and agriculture at a later date. Making the transition from an environment-focused approach to one that is more inclusive will be one of the continuing challenges in the years ahead;

(b) Many countries have embarked upon a broad process of national consultation involving a wide range of stakeholders from both outside and inside Government. Niger has established a National Council on Environment and Sustainable Development, which conducted a national forum in September 1997. Bhutan, Bolivia, Burkina Faso, Estonia, Jordan, Kyrgyzstan, Mongolia, Morocco, Pakistan, Peru, the Philippines and the United Republic of Tanzania all have similar processes to encourage dialogue among diverse interests. Creating a real national consensus behind sustainable development seems critical to providing the support and energy to drive the implementation process;

(c) It appears to be easier to achieve more coherent approaches to sustainable development planning at the local, municipal and regional levels where the presence of less entrenched organizations, the closer scrutiny of citizens and the entry of a younger generation of leaders into positions of authority is leading to progress. The next task will be to ensure greater support of local initiatives by central authorities, for example, by using co-management approaches to resources management.

C. Priorities for action at the country level

6. Several areas are emerging as key priorities at the country level:

(a) Opening up the process of capacity-building to include a full range of national actors seems to be a critical first step either through decentralization, State-civil society partnerships, privatization or consultative approaches. Without this greater level of participation, the older, formal structures of Government cannot, by themselves, provide the energy, creativity, insights and resources that are critical to developing the capacities for sustainable growth;

(b) Most countries are now engaged in some form of public-sector reform designed to make Governments more responsive and cost effective. Greater attention needs to be paid in these reform efforts to shifting the role of central Governments – making them more oriented towards setting broad frameworks within which other non-state actors can take responsibility for programme implementation and service delivery;

(c) Capacity development for sustainable development is more than a financial or technical or organizational activity. It clearly requires that countries embed some of the "rules of the game" in legal covenants to ensure compliance and guidance for national participants. Reform of the judicial system is also a priority in many countries;

(d) Implementation of capacity-building needs effective monitoring and evaluation to provide learning and lessons of experience. This, in turn, requires approaches to monitoring and evaluation that are less donor-driven, less defensive and more attuned to the learning needs related to capacity-building.

D. Recommendations

7. The Commission on Sustainable Development could lend its support and encouragement to the process in the following ways:

(a) **The international community should reinforce the idea that countries at any level of development can make genuine progress in building their capacity for sustainable development, provided that the process is driven by national commitment and ownership.** The growing effort in many countries to involve a wide range of participants is one of the most encouraging trends to date;

(b) **Funding agencies should give greater support to capacity-building activities.** The African members of the Board of Governors of the World Bank have persuaded the Bank to move in this direction and other donors should be encouraged to do so in specific operational ways. **Increased support should also be complemented by continuing the shift in funding agency interventions – that is, less direction and control, greater orientation towards facilitation and support and more non-project funding;**

(c) **Countries should learn from each other's experiences and adopt approaches moving away from command and control techniques and towards more experimentation, as in the case of the Beijing Watershed Development Programme. Governments need to move towards greater transparency of information.** In the region, covered by the Economic and Social Commission for Asia and the Pacific, exchange of information is a key component of a poverty alleviation programme designed to enhance the incomes of the rural poor by replicating successful micro-enterprises, which is currently being implemented in eight countries. **Funding agencies should devote more resources to activities in support of learning, including case studies for practitioners, more action-oriented research and the continued support for electronic networks that can link groups around the world;**

(d) **Countries should seek to increase their own capacity through subregional cooperation in cost-effective ways.** Capacity-building programmes are increasingly an integral part of subregional cooperation programmes. Good examples of subregional capacity-building programmes can be found in the Caribbean, South Pacific and North-East Asia regions.

III. Education, public awareness and training: chapter 36 of Agenda 21

A. Current status and trends

8. The first report on education, public awareness and training was submitted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) to the Commission on Sustainable Development at its fourth session, in 1996. At that time, a special work programme was initiated, in which priorities for action and key actors were designated. The nineteenth special session of the General Assembly gave added impetus to the implementation of chapter 36 of Agenda 21. The information provided below includes an expanded version of the work programme initiated in 1996. Additional information on the issues addressed in the present section is contained in document E/CN.17/1998/6/Add.2.

9. There is growing recognition within political and economic circles of the critical role of education as part of the enabling framework for sustainable development. Education is now widely acknowledged as a means to prepare people to engage with Governments, business and industry, to support changes in governance and the marketplace and to adapt to a complex and rapidly changing world. Ministries of finance and planning, as well as other sectoral ministries, are increasingly targeting education as an underpinning for solving economic, social and political problems. Education is recognized as a driving force for changing values and mind sets, which can in turn lead to behavioural change. Education is an integral element in debates on such key issues as poverty, population, health, employment, environmental management, consumption and production, and technology transfer, all of which are essential ingredients of sustainable development.

10. It is increasingly recognized that sustainable development encompasses all disciplines, and requires that education acknowledge the disciplines in their relationship to each other, engaging all levels and forms. Education does not mean formal education alone. It includes non-formal and informal modes of teaching and learning, such as those that take place in the home and community.

11. The purpose of the background document entitled "Educating for a sustainable future: a transdisciplinary vision for concerted action", is to provide a conceptual framework and serve as the basis for regional strategy papers or action programmes. The International Conference on Environment and Society: Education and Public Awareness for Sustainability, co-organized by UNESCO and the Government of Greece in Thessaloniki in December 1997, addressed this issue, as did numerous other meetings held during 1997 to celebrate the twentieth anniversary of the Tbilisi Intergovernmental Conference on Environmental Education, including the Conference PlanetERE, held in Montreal, Canada, in 1997 for francophone countries.

12. To accelerate progress towards sustainable development, emphasis has been shifting to action at the national and local levels. An important theme continues to be the inadequacy of financing for education, despite the consensus among Governments of its importance. This evolution has important implications for how institutions orient their work and for the allocation of resources. The United Nations system, for example, is working to improve the coordination of services at the country level. To support this, UNESCO is launching an inter-agency initiative on education for a sustainable future in a number of countries.

13. The creativity and risk-taking required for innovation in educational institutions and for meeting new challenges, are diminished by downsizing, reductions in resources and heightened competition. Moreover, experience has shown that partnerships in the abstract tend to divert energy and resources without delivering concrete results. The increasing

emphasis on work at the country level is expected to help focus joint efforts, since alliances and partnerships tend to be most effective when they are centred on concrete initiatives where the contribution of each partner is essential to achieving common and concrete goals.

B. Action required

14. Further to the programme of work on education and public awareness adopted in 1996, the following subprogrammes and partnerships in implementation are presented below for further consideration. Once agreed, progress made in implementing the work programme should be monitored on a regular basis.

1. Clarifying the concept and key messages of education for sustainable development

15. The concept and key messages must be further developed and implanted at the regional and national levels by:

(a) Preparing regional education strategy papers, which would in turn be taken up at the national level;

(b) Analysing the action plans of all the major United Nations conferences, the conventions on biological diversity, climate change and desertification, the Agenda for Development (General Assembly resolution 51/240), and regional action plans for sustainability, with a view to promoting the integrated follow-up to those agreements with respect to education and public awareness under the umbrella of chapter 36;

(c) Formulating the core messages of education for sustainable development that need to be communicated at all levels of education and through all channels, and mobilizing diverse networks of experts to that end.

16. Governments and the media are encouraged to undertake information campaigns to communicate to the public the key messages of sustainable development. Governments should provide incentives to the media for this purpose.

2. Reviewing national education policies and reorienting formal educational systems

17. Governments are urged to develop, within five years, policy statements for reorienting education towards sustainable development, including a definition of what needs to be done at the local, national and regional levels, so that all actors will understand their respective roles and responsibilities. The participation of local authorities and other local actors in this process should be ensured. The United Nations system, governmental and non-governmental organizations and the education and scientific communities are called on to provide assistance to this endeavour.

18. Priority needs to be given to teacher training in reorienting formal education systems. The approximately 60 million teachers worldwide need to be engaged in this process. Governments are urged to ensure that within five years measures have been taken in this direction. International and national representatives of teachers (including unions) should be involved, as well as specialists in higher education.

19. Institutions of higher education should adapt their teaching and research to promoting an interdisciplinary approach conducive to addressing sustainable development issues. Governments and the academic community are urged to support this process. The World Conference on Higher Education in 1998, and its follow-up, should give due consideration to the reform of higher education systems to support sustainable development. Likewise, the World Science Conference in 1999 should consider how to ensure that educational reform draws on scientific knowledge and how to integrate knowledge emanating from the disciplines in the service of sustainable development.

20. In view of the long-term implications of educational reform, Governments need to ensure the continuity required for reform efforts to be fully implemented. Progress made in this regard should be regularly monitored at the international level.

3. Incorporating education into national strategies and action plans for sustainable development

21. Education and public awareness should be made significant components in regional, national and local strategies and plans for sustainable development. Governments, working with civil society, the private sector, the education community and others need to ensure such integration. National and local governments are encouraged to establish national and local committees for this purpose, which should be interdisciplinary, involve all sectors, and ensure the full participation of both governmental and non-governmental bodies. The United Nations system, in partnership with other key international institutions, should be called upon to assist in the integration of educational concerns into such

strategies and plans at the country level. A survey of existing regional and national strategies and plans to determine the extent to which education has been adequately addressed, initiated by UNESCO, in cooperation with the Department of Economic and Social Affairs of the United Nations Secretariat and UNDP, should be completed and recommendations developed on that basis.

4. Educating to promote sustainable consumption and production patterns

22. Initiatives are needed to link the work programmes on education and on changing consumption and production patterns. Such initiatives could include raising awareness of the implications of current unsustainable patterns of consumption and production; dissemination of the revised guidelines for consumer protection; partnerships with industries and the media to work out strategies for advertising; making use of educational tools and consumer feedback mechanisms to facilitate policy-making; and developing and promoting social instruments through education and training intended to change consumption and production patterns. The task managers for chapters 4 and 36 of Agenda 21 (Department of Economic and Social Affairs of the United Nations Secretariat and UNESCO), working together with other relevant organizations, including the United Nations Environment Programme (UNEP), the Organisation for Economic Cooperation and Development (OECD), and representatives of business and industry, should develop concrete recommendations for initiatives along these lines.

5. Analysing and redirecting investments in education

23. The proposed review by the international financial institutions on current investment in education from the perspective of sustainable development should also consider financing by Governments and by major groups. Based on such a review, a strategy for mobilizing greater resources to finance education from all sources should be developed.

6. Identifying and sharing innovative practices

24. It is important to continue to identify and share innovative practices in support of education and public awareness for sustainability, at the local, national, regional and international levels. An international electronic registry is being developed by UNESCO, with the assistance of the Government of the United States of America, to address this need by establishing a second generation Web site and a knowledge management system for chapter 36 of Agenda 21. Innovative case studies from non-conventional sources, such as various major groups including industries, women, youth and non-governmental organizations, should be included in such an inventory. Regional networks and forums for sharing innovative practices should be encouraged.

7. Partnerships in implementation

25. The following are some ways in which partnerships can be further strengthened:

(a) Public-private cooperation should continue to be enhanced for launching effective education and training of workers, as well as for undertaking public awareness campaigns, including through the media and through advertising, with a view to promoting sustainable consumption and production patterns and the use of environmentally sound technologies, and to communicating other key issues of sustainable development;

(b) The involvement of the scientific and technological community in enriching education, training and awareness-raising programmes needs to be enhanced, particularly to promote the understanding of crucial sustainable development issues of concern at the local and national levels;

(c) Youth have been important advocates for sustainable development, especially at the community level. Innovative programmes such as the youth indicators programme should be identified and encouraged and new ones developed. At the same time, they should be made part of national dialogues and decision-making on education;

(d) Women, especially in rural communities, usually play a key role in the economic as well as in the social and cultural aspects of life. The local community and the household are important entry points for messages on sustainable development, especially for adults and out-of-school children. Programmes to strengthen the role of women in these contexts should be promoted;

(e) Non-governmental organizations are critical partners in catalysing action and awareness-raising for advancing sustainable development and mobilizing civil society to take initiatives in their communities. The role of non-governmental organizations at the national and local levels is growing exponentially and their innovative practices should be widely disseminated.

IV. Science for sustainable development: chapter 35 of Agenda 21

A. Sound scientific knowledge

26. The first report prepared by UNESCO on science for sustainable development was submitted to the Commission on Sustainable Development at its third session, in 1995. Implementation of the different sectoral and cross-sectoral chapters (e.g., freshwater and health) of Agenda 21 must be based on sound scientific knowledge. Consequently, the specific monitoring, research, training and institution-building requirements for dealing with these specific environment and development issues form an integral part of the implementation of those chapters. More detailed information on the issues addressed in the present section is contained in document E/CN.17/1998/6/Add.3 and in a background paper entitled "Report on international scientific advisory processes on the environment and sustainable development"

B. Training, capacity-building and education in science

27. Each country must possess the scientific capability needed to master its own path to sustainable development. Given that the majority of developing countries today fall short of this objective, their national investment in higher education in science and in scientific institution-building should be significantly increased. Specific attention should also be given to capacity-building related to the development and implementation of national science and technology policies and systems of innovation. In this context, strong and concerted international support to build up the scientific community and scientific infrastructures in developing countries, in particular the least developed countries, is an urgent requirement.

28. Science education, in the larger sense of the term, continues to be neglected and should be reinforced in all school curricula and at all levels of society in developing and industrialized countries alike. Activities aimed at strengthening science education at the national and international levels are *ipso facto* related to the broader issue of education, awareness-raising and training for sustainable development (chapter 36 of Agenda 21) and should be developed through close cooperation between scientific and educational institutions and departments.

C. Improving scientific knowledge for sustainable development

29. There is already a solid foundation of knowledge for most "development and environment" issues included in Agenda 21, but it is equally true that for almost all these issues great gaps in knowledge remain. Predominantly disciplinary research within the key problem areas needs to be complemented by a holistic interdisciplinary approach to research. Moreover, research needs to become more pro-active and to focus on prevention and early identification of emerging problems – and also opportunities – rather than on tackling problems only when they become acute, as it does at present. Poverty reduction should also be another priority for research on sustainable development.

30. The allocation of national funding to sustainable development research is woefully insufficient. Another unsettling fact is that financial support for international scientific cooperation programmes is stagnating or, in some cases, even diminishing. This reduces in particular support for developing country participation in these activities.

D. Strengthening international cooperation in long-term observations and the free exchange of data and information

31. Reducing scientific uncertainty requires long-term observations of both natural and man-modified systems. Long-term systems observations are also essential to be able to assess the causes and the extent of change, as well as the impact of remedial measures. Under the umbrella of Earthwatch, coordinated by UNEP, the relevant organizations have started to develop the scientific foundations for comprehensive global observing systems for the major components of the Earth system: the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS) and the Global Terrestrial Observing System (GTOS). Cooperation between the three systems is promoted through a Joint Sponsors Group consisting of UNEP, the World Meteorological Organization, UNESCO and its Intergovernmental Oceanographic Commission, the Food and Agriculture Organization of the United Nations, the World Health Organization and the International Council of Scientific Unions (ICSU).

32. The fully fledged development and the long-term sustainability of these observation systems is at present far from assured owing to the shortage of both international core

funds and support for national and regional activities contributing to the observing systems. In fact, there is at present even a decline in the existing national and regional monitoring activities and networks due to lack of appropriate funding, including in many industrialized countries.

33. Development of international observing systems and resulting databases as well as scientific advances in general rely on full and open access to data. A market model for access to data and information is unsuitable for science in general and international scientific cooperation in particular.

34. New information systems and communication technologies hold the promise of offering rapid, worldwide access to scientific resources, but it will be a major challenge to convert this promise into reality. The investment in telecommunication systems and networking services that is required to provide open access to these electronic networks is currently well beyond the reach of many developing countries, particularly the least developed countries.

E. Knowledge-based policies and action: the role of international scientific advisory processes

35. A precondition for providing the best scientific advice available on major international environment and development issues is the conducting of comprehensive assessments of the scientific knowledge available on the issues in question. An analysis of existing international scientific advisory processes is provided in the background paper entitled "Report on international scientific advisory processes on the environment and sustainable development", prepared by a UNEP consultant, in consultation with UNESCO. A summary of the policy issues addressed in that report is provided in document E/CN.17/1998/6/Add.3.

36. Several general conclusions can be drawn from the above. First, the modality of providing scientific advice needs to be carefully selected to suit different requirements in different contexts. Second, the best scientific advisory processes are those that combine scientific excellence and intellectual independence with a close dialogue and cooperation with policy makers and implementers, as in this way only can the concerns and needs of the recipients of scientific advice be adequately addressed. Third, there is considerable risk of duplication in the work of existing international scientific advisory bodies. Fourth, efforts need to be enhanced to ensure full participation by experts from developing countries, including, if necessary, through "on the job" training and other capacity-building measures. Fifth, although the Internet represents an invaluable source of information, in no way can it replace the scientific work done at present through scientific assessments and scientific advisory bodies.

F. Proposals for action

37. **Countries, in particular developing countries, should define national strategies, policies and plans for the purpose of ensuring the development of scientific, capacity for the benefit of sustainable development, the management of science, including improved research management, the integration of science in national sustainable development plans and national participation in high priority international scientific endeavours. Special emphasis should be placed on ensuring an equal opportunity for women in science.**

38. **In order to address the shortcomings of higher education in science in many developing countries, in particular those in Africa and the least developed countries, measures to be taken should include:**

(a) Undertaking a comprehensive rehabilitation of research and teaching infrastructures in universities, and their proper re-equipping as a critical precondition for the development of capacity in science and technology, including the provision of the necessary funds from national sources;

(b) Incorporating support for higher education and relevant research in the funding for technical assistance programmes in the broad field of environment and sustainable development;

(c) Bilateral and multilateral donor cooperation within each country and for regionally organized postgraduate training programmes and South-South training and research programmes;

(d) Establishing university-industry partnerships;

(e) Putting in place modern information technologies so as to ensure easy access to the resources of libraries and documentation centres.

39. **Specific programmes should be developed and/or reinforced in industrialized and developing countries alike to strengthen science education for all groups of society, not only at the primary and secondary levels of formal education, but also in the context of informal education.**

40. **Predominantly disciplinary research within the key problem areas should be complemented by a holistic**

interdisciplinary approach to research. Moreover, research must become more action-oriented and proactive with a greater focus on prevention and early identification of emerging problems – and also opportunities – rather than its present focus on solving problems only once they have become acute. Action-oriented interdisciplinary scientific programmes for sustainable development, sponsored by several United Nations agencies, should receive enhanced support.

41. Long-term observations of the environment are essential in order to be able to improve knowledge leading to better management of the global observing systems and to assess change and the impact of policy measures. Governments of industrialized and developing countries alike should join forces with international organizations and the scientific community to develop global environmental observing systems related to climate, oceans and terrestrial ecosystems. Governments of developed countries should ensure that these endeavours receive adequate international core funds.

42. Both scientific databases established with public funds and data exchanges for the purposes of scientific work should be exempt from commercial regulations. Scientists and other users worldwide should continue to enjoy free access to scientific databases from all sources in exchange for a modest contribution towards the cost of producing and communicating a specific set of data.

43. The Commission on Sustainable Development may wish to invite UNEP, in cooperation with UNESCO and other United Nations agencies and international scientific organizations as well as the secretariats of the conventions concerned, to prepare proposals for improved coordination and cooperation among scientific and technical advisory bodies to these conventions.

44. Pursuant to the decisions of the governing bodies of UNESCO and ICSU to jointly organize in June 1999 a World Science Conference, in cooperation with other United Nations agencies and international scientific organizations concerned, the greatest attention should be given by the Conference and during its preparatory process to addressing the key issues of science for sustainable development. Science must be given a boost as it is no exaggeration to assert that without enhanced science there can be no sustainable development.

45. Governments in developing and developed countries alike should take appropriate measures to mobilize increased investment in research and development at the national level, with a focus on science for sustainable development. Multilateral and bilateral donor agencies and Governments should step up significantly their support for developing countries in this regard. Increased financial support should also be provided to relevant international scientific cooperation programmes.

V. Transfer of environmentally sound technology: chapter 34 of Agenda 21*

A. Technology transfer and sustainable development

46. Technology is critical to economic growth and sustainable development. The development and dissemination of new and improved technologies contributes to the increased production and introduction of goods and services, and to production processes that are more resource efficient and less polluting. In general, however, increases in the volume of production and consumption are outpacing the introduction of cleaner technologies, contributing to continued deterioration of the global environment.

47. Sustainable development requires accelerated development, transfer and dissemination of both cleaner technologies for existing production and consumption patterns, and innovative technologies that meet people's needs in new and more sustainable ways. In particular, sustainable development on a global basis requires accelerated transfer of environmentally sound technologies from developed to developing countries.

48. While business and industry play a crucial role as responsible entrepreneurs in the development and transfer of environmentally sound technologies, Governments still have a major role to play in setting the policy framework and providing incentives for business and industry to contribute to sustainable development on a global basis. Making eco-efficiency a management objective in business planning and operations is an important step towards sustainable development and may require substantial changes in business strategies. In order to promote improvements in eco-efficiency, there is a need for further development of measurement methods, environmental performance indicators and technology benchmarking, including the assessment and adoption of new and cleaner technologies.[2]

* For more detailed information, see document E/CN.17/1998/6/Add.1.

49. Government policies need to be based on a thorough understanding of the factors influencing companies' environmental and economic performance, including their adoption of best practices in environmental management and use of environmentally sound technologies in production processes.

50. Small and medium-sized enterprises, in particular, have come under pressure from consumers, client enterprises and environmental regulations to improve environmental performance, but often have difficulties meeting these requirements. Small and medium-sized enterprises should be supported by national and local authorities and should have access to consultants and researchers who can assist in applying eco-efficiency in business strategies, planning and operations. Networks of organizations and experts that can assist small and medium-sized enterprises need to be established. The European Roundtable on Cleaner Production is a step towards creating such a network in Europe, and similar initiatives should be undertaken in other regions.

51. Cooperative arrangements among chambers of commerce and other business and industry organizations in developed and developing countries could help in spreading best practices, including training in technical skills and know-how, management practices and the use of new management tools, and institutional cooperation. Programmes such as Asia EcoBest, developed by the Regional Institute for Environmental Technology in Singapore is an example of successful cooperation.

B. Policies for promoting the transfer of environmentally sound technologies

1. Strengthening technology cooperation

52. The Technology Cooperation Workshop, organized by the United Kingdom of Great Britain and Northern Ireland under the auspices of the Advisory Committee on Business and the Environment,[3] suggested that there is a need for the development of guidelines or codes of practice for Governments on technology cooperation. Such guidelines or codes of practice should identify, based on existing experience and emerging opportunities, areas for government policy interventions to promote technology partnership initiatives between economic actors in developed and developing countries and to remove obstacles to such initiatives. There is a need to identify the potential actors, including Governments, business and industry, research and development institutions and technology centres, and to examine their respective roles, specific interests and priorities in technology partnership initiatives.

53. Technology partnership initiatives should take into account economic opportunities and the capacities of the developing country partners for technology integration, management and dissemination. They should be designed to include the transfer and adaptation of specific production technologies, long-term capacity-building and cooperation in further research and development. The economic, environmental and cultural context of the partners from developing countries should be considered in selecting the technologies to be transferred.

54. There is a need for further study of the effectiveness of various incentives and economic instruments for attracting the participation of private sector companies from developed countries in technology partnership initiatives with developing country partners.

55. Finally, mechanisms and tools must be developed to monitor and measure the effectiveness of technology partnership initiatives for achieving specific economic, social and environmental goals and targets as defined by the partners.

2. Increasing the transfer and dissemination of environmentally sound technologies resulting from publicly funded research activities*

56. The International Expert Meeting on the Role of Publicly-funded Research and Publicly-owned Technologies in the Transfer and Diffusion of Environmentally Sound Technologies, organized by the Republic of Korea, concluded that Governments can play a considerable role in the establishment of an institutional framework within which the identification, assessment, transfer, adaptation and post-transfer follow-up of environmentally sound technologies can take place, in particular in the case of environmentally sound technologies resulting from publicly funded research activities. Building and strengthening cooperation between information systems, national cleaner production centres, centres for innovation and enterprise development, and other intermediaries would be a necessary step in establishing such a framework.

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* This section is based on the report of the International Expert Meeting on the Role of Publicly-funded Research and Publicly-owned Technologies in the Transfer and Diffusion of Environmentally Sound Technologies, Kyongju, Republic of Korea, 4-6 February 1998 (see E/CN.17/1998/12).

57. The Expert Meeting also concluded that the transfer and dissemination of publicly funded environmentally sound technologies generally takes place through existing technology transfer mechanisms, including intra-enterprise transfers (direct investment), joint ventures, environmentally sound technology licensing arrangements, and agreements between developing and developed country enterprises or research institutions to jointly develop and commercialize environmentally sound technologies.

58. Moreover, many technological innovations, including most of those that result from publicly funded research activities, are not patented or commercialized by their developers, but are published in technical literature. This knowledge is freely available for commercialization by enterprises with the necessary capacity.

59. Based on the work of the Expert Meeting, the policy options set out below might be considered by the Commission on Sustainable Development for further action.

60. **Governments of developed countries should provide incentives to accelerate the transfer and dissemination of publicly funded environmentally sound technologies to developing countries, including tax incentives, promotion of environmentally sound technology-related imports, and technology transfer in exchange for intellectual property protection.**

61. **Governments, with the support of international organizations and financial institutions, should support small and medium-sized enterprises, including through funding of feasibility studies on market opportunities and commercial viability of environmentally sound technologies, fiscal incentives such as lower taxes or tax holidays, export promotion programmes such as trade missions targeted towards environmentally sound technologies, and assistance in the development of business plans.**

62. **Business risks for environmental enterprises should be reduced, for example through various types of financial assistance such as grants, venture capital investments underwritten by Governments and loan guarantee schemes.**

63. **Governments and international organizations should support and encourage pilot and demonstration projects related to the use of environmentally sound technologies in developing countries.**

64. **Governments, with the support of international organizations, should develop new mechanisms for the sharing and exchange of environmentally sound technologies, such as bilateral and multilateral memoranda of understanding and environmentally sound technology pooling or banks. Further studies of mechanisms for improving the dissemination of environmentally sound technologies should be encouraged.**

65. **Governments should promote the transfer to developing countries of non-patented or uncommercialized technologies resulting from publicly funded research activities, including through technology cooperation. Transfer of such knowledge can contribute to capacity-building in developing countries as well as to the use of these results.**

66. **Governments should promote joint research and development activities between institutions in developed and developing countries in order to strengthen capacity-building and training, and encourage the sharing of the results of joint research and development activities, including joint patenting.**

3. Developing national technology strategies

67. **National strategies for technological development are an important element of development strategies. They should be targeted towards strengthening national technological research and development capacities and improving the capacity for technology transfer, integration and dissemination.**

68. **Governments of developing countries should be encouraged and supported in their efforts to focus technology strategies on industries that are particularly important with respect to economic growth, natural resource consumption and environmental pollution.** The objective should be to identify areas where a country's development "opportunities" match its national "capacities" for technology innovation, integration and dissemination, and areas where technology cooperation is needed to bridge the gap between "opportunities" and "capacities". In defining a technology development strategy, it is important to take into account the different interests and capacities of various stakeholders.

69. **Regional expert group meetings, jointly organized by Governments and United Nations agencies, can be a useful mechanism to develop guidelines or manuals, as tools for the development of technology strategies.** The guidelines for national technology needs assessment adopted by the Commission on Sustainable Development in 1996 may be useful in developing such guidelines or manuals.

Notes

[1] The task managers for chapters 34-37 of Agenda 21 are as follows: Department of Economic and Social Affairs of the United Nations Secretariat for chapter 34 (Transfer of environmentally sound technology, cooperation and capacity-building); United Nations Educational, Scientific and Cultural Organization for chapters 35 (Science for sustainable development) and 36 (Promoting education, public awareness and training); and United Nations Development Programme for chapter 37 (National mechanisms and international cooperation for capacity-building in developing countries).

[2] See the Chairman's summary of the Roundtable on Business and Sustainability, hosted by European Partners for the Environment under the patronage of the European Council and the Commission of the European Communities (Brussels, 11 February 1998).

[3] See the summary report of the Technology Cooperation Workshop, held by the United Kingdom of Great Britain and Northern Ireland under the auspices of the Advisory Committee on Business and the Environment (London, 10 December 1997).

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Capacity-building, education and public awareness, science and transfer of environmentally sound technology

Report of the Secretary-General

Addendum

Areas for policy action by Governments to accelerate the development, transfer and dissemination of environmentally sound technologies

Chapter 34 of Agenda 21

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I. Introduction

1. The present report supplements the information contained in section V (Transfer of environmentally sound technologies) of document E/CN.17/1998/6, and suggests areas for future action by Governments.

2. The report is based in part on the reports of the Expert Meeting on the Role of Publicly-funded Research in the Transfer and Diffusion of Environmentally Sound Technologies, organized by the Republic of Korea (Kyongju, 4-6 February 1998); the Technology Cooperation Workshop, held by the United Kingdom of Great Britain and Northern Ireland under the auspices of the Advisory Committee on Business and the Environment (London, 10 December 1997; and the European Roundtable on Business and Sustainability, hosted by European Partners for the Environment under the patronage of the European Council and the Commission of the European Communities (Brussels, 11 February 1998).

II. Trends related to the development, transfer and dissemination of environmentally sound technologies[1]

3. Since existing production and consumption levels are already responsible for environmental stress in many areas, the accelerated development and application of new technologies that could bring about considerable improvement in energy and material efficiency will be required to ensure sustainable development.

4. In order for companies to remain competitive and to meet increasingly stringent environmental standards, they will need to move towards greater eco-efficiency and cleaner production. The "trendsetters" will need to be companies in developed countries that have the resources and capacities to invest in best practices in environmental management and environmentally sound technologies. Emerging global standards for environmental management systems (for example, the Eco-Management and Audit Scheme (EMAS) and ISO 14000) have created strong incentives for this move to eco-efficiency and cleaner production.

5. Information and communication technology (ITC) is at the forefront of technological advances in environmental protection (environmental monitoring, risk control, management systems, simulation and so forth). ITC is also a means to spread best practices. The use of ITC for environmental protection, exchange of experience, information access and technology transfer is becoming an important success factor in efforts towards sustainable development.[2]

6. While necessary, the use of regulatory regimes alone is no longer regarded as sufficient to stimulate the adoption of environmentally sound technologies by companies. Increased emphasis is being put on a wider use of market-based instruments and voluntary approaches, including the adoption of environmental management systems, giving industry the choice of the means to achieve the goals and targets established by Governments, while providing the incentives for companies to innovate.[3]

7. Small and medium-sized enterprises (SMEs), especially in developing countries, have particular difficulties in adopting environmentally sound technologies and management systems, due to limitations in technological capacity, access to finance and information. As a result, SMEs often produce disproportionate amounts of industrial waste and pollution. Policies and programmes to promote sustainable development should include particular support to SMEs to enable them to acquire, use and manage environmentally sound technologies.

III. Areas for future action by Governments

A. Strengthening technology cooperation

8. Technology transfer to developing countries has an important role to play in achieving sustainable development objectives on a global scale. It stands the best chance of success when it builds upon partnership arrangements involving public and private sector actors from developed and developing countries. Cornerstones are shared responsibility, clear commitments, achievable targets, recognition of mutual benefits, building of confidence and dealing with cultural differences in a sensitive and positive way.

9. Partnerships use different mechanisms to transfer and disseminate environmentally sound technologies, such as joint ventures, direct investment, sourcing agreements, co-production arrangements, licensing, and strategic alliances between firms and R&D institutions. Training in management and technical skills and know-how should be part of technology partnerships. Intermediaries could help in these activities.

Box 1

European Union programme supports small and medium-sized enterprises

The European Union Structural Funds Programme (1994-1999) is providing 1 billion ECU for small and medium-sized enterprises, channelled through grants to member States and aimed at developing clean technologies and clean production within highly competitive markets.

Source: "1997 Guidelines on national reporting", Part V, "Guidelines on Technology", submitted by the Commission of the European Communities to the Commission on Sustainable Development at its present session.

Box 2

Disseminating best practices in business and industry

The European network, PREPARE, represents a group of cleaner production experts from industry, research and government from 18 countries. Its activities include the exchange of information on cleaner production technologies and cleaner production development (eco-design), the evaluation of results of cleaner production efforts as well as the stimulation of industry-oriented R&D projects. Currently, PREPARE is launching thematic networks in the field of cleaner production. One of the networks aims at disseminating environmental best practices in small and medium-sized enterprises in Europe.

Source: PREPARE secretariat.

10. Technology cooperation should consider the legal and political factors, institutional structures and social norms within which cooperative arrangements are implemented. Where companies conduct business in developing countries, they have a responsibility to ensure that the social dimension of their activities is also sustainable. It is important in this respect to involve, at an early stage, all relevant stakeholders in a multi-stakeholder dialogue.

1. Mechanisms for the transfer of environmentally sound technologies

11. Perhaps the simplest technology transfer process, making the least demand on technological capacity in the recipient country, is an intra-enterprise transfer, through direct investment. The parent enterprise located in a developed country provides the equipment, management structure, practical experience, training and often connections to export markets to its subsidiary located in a developing country. There is evidence, however, that the technology and practices transferred through direct investment, find limited dissemination to other enterprises or sectors of the recipient developing country. Governments could promote such transfers through financial incentives to enterprises, including tax incentives and investment guarantees.

12. Another mechanism is joint ventures between enterprises of developed and developing countries, either with or without licensing or other direct payment for the technology. Experience indicates that joint ventures tend to be more effective in disseminating new technologies, but require a relatively high level of commitment on both sides and well-developed capacities in the recipient enterprise for technology adaptation, use and management. In addition to the use of tax and investment incentives, Governments could promote joint ventures for the transfer of environmentally sound technologies by facilitating contacts between enterprises in developed and developing countries. Governments could also finance or otherwise support the dissemination of information on technologies and enterprises, participation in trade fairs, visits between enterprises, and contacts through government channels.

Box 3

Driving environmental business in Asia

The Commission of the European Communities and Singapore jointly established the Regional Institute for Environmental Technology (RIET) in Singapore to promote the transfer and exchange of environmental know-how and services between Europe and Asia. RIET's network contains many leading suppliers of environmental technologies and management companies from Europe and the Asia and Pacific region. To serve suppliers, RIET opened the door to over 4,000 customers in the region through market information, client-centred research, and business development support. Driving demand, RIET each year helps several hundred Asian companies address environmental problems through environmental management support and project or equipment brokerage. During the period 1997-2002, the European Community reserved 8 million ECU for the Asia EcoBest project to promote European environmental best practices in Asia.

Source: "Europe-Asia co-operation strategy in the field of environment" (COM(97)490-Final), communication from the Commission of the European Community to the European Council, the European Parliament and the Economic and Social Committee.

13. Where developing country enterprises or institutions have research and development capabilities in a particular area of technology, they could opt for entering into agreements with enterprises or institutions of developed countries to jointly develop and commercialize environmentally sound technologies. Such agreements require a high level of technological capability and the willingness to undertake relatively high-risk investments, but have the advantage of shared benefits resulting from the commercialization of the technology jointly developed, including joint patenting or licensing.

14. Licensing arrangements between enterprises in developed and developing countries is another mechanism to transfer technology. Licensing arrangements could involve partnerships or strategic alliances with the source enterprise, through supply agreements or cooperation in local or regional marketing. The recipient party may also use third-party assistance for the development of the capacity to commercialize technology. Governments could assist such licensing arrangements, through, for example, financial assistance for licensing costs and assistance in training and capacity-building of the recipient enterprise in the developing country.

2. Promoting technology cooperation between developed and developing countries

15. Governments, enterprises, R&D institutions and intermediaries concerned with technology development, transfer and dissemination are increasingly working together to accelerate the application of research results to commercial production. Different forms of technology cooperation are being created to combine the resources and capacities of the various partners in research, development, commercialization, adaptation, dissemination and further innovation. To date, this cooperation has been largely limited to developed countries. There is a need to extend them to include partners from developing countries.

16. Based on the work of the Technology Cooperation Workshop, organized by the United Kingdom under the auspices of the Advisory Committee on Business and the Environment, the following conclusions may be drawn.[4]

17. There is no single model for technology cooperation. Flexibility is essential to match the needs and capacities of technology users with market opportunities and the interests of technology suppliers. Supply and demand are interactive processes. Suitable technological solutions are often the result of merging high-tech industrial know-how, which is in the hands of technology suppliers in the developed countries, with low-tech indigenous knowledge existing on the side of the users in the developing country.

18. Successful technology cooperation often seems to be related to the application of technologies with a proven track record. This reduces the risk for the recipient and reassures providers of finance as to cost-effectiveness and predictability – especially for public sector authorities who tend to be more cautious than potential private sector

Box 4

United Kingdom Technology Partnership Initiative (TPI) has been successful

Since it was launched in 1993, TPI has made progress in developing a network of potential users of environmental technology and services. By the end of 1997, the number of network members had risen to nearly 6,000. It has gained international recognition in that TPI was one of the first to define the critical components for disseminating information about technology transfer. Although experience suggested that the basic components of TPI are right, adjustments are necessary in its strategy at the time of its renewal in April 1999, so as to achieve more hands-on, in-depth cooperation with key decision makers in participating developing and industrializing countries.

Source: TPI secretariat, Joint Environmental Market Unit, Department of Trade and Industry and Environment of the United Kingdom of Great Britain and Northern Ireland.

backers. Technologies with a proven track record may also be helpful in securing the support of local communities whose commitment is often a vital ingredient. However, at least some adaptation to local circumstances is almost always required, reinforcing the advantages of working with partners with local knowledge and experience and staying close to existing and potential customers.

19. Recipient companies or Governments sometimes lack trust in low-tech solutions. Other obstacles may relate to cultural factors, differences in business practices and structures, suspicions of "foreign" technology or technology with an unproven track record, or the discounting of technology unless it was seen as new or "fashionable". Pilot and demonstration projects are useful to overcome these and other obstacles and to demonstrate the viability of certain technologies under local circumstances.

20. There is, in principle, no shortage of information about technology needs or the range of available technologies. There are, however, problems regarding the availability of the "right" information reaching the right people in the right form. Developed country Governments and industry trade associations could do more to help their existing and potential technology suppliers, especially SMEs, with information on opportunities and requirements for technology transfer to developing countries, and encourage contacts with potential partners through missions and other networking activities. Developed countries could also support developing countries in undertaking technology needs assessment projects. A sectoral approach in both these areas appears to be most effective.

21. Official Development Assistance (ODA) should support and leverage assistance for management training and other programmes for capacity-building on the side of existing and potential technology users in developing countries. Intermediaries, including private and public sector consultancy services, information systems, technology centres and centres for enterprise development, should be used and further encouraged to undertake such activities.

B. Increasing the transfer and dissemination of environmentally sound technologies resulting from publicly funded research

22. In response to a specific recommendation in the Programme for the Further Implementation of Agenda 21,[5] the Republic of Korea sponsored a project on the role of publicly-funded research and publicly owned technologies in the transfer and diffusion of environmentally sound technologies. The project was jointly implemented by the United Nations Conference on Trade and Development, the Department of Economic and Social Affairs of the United Nations Secretariat and the United Nations Environment Programme. For the project, a number of country case studies and studies on selected policy, legal and institutional issues were carried out. The results of these studies were presented to an expert group meeting, organized by the Republic of Korea.[6]

23. The meeting concluded that public funding remains a major source for R&D activities and is particularly vital for R&D on environmentally sound technologies. Many Governments, especially of developed countries, have allocated considerable funds to finance or co-finance research activities for the development of new technologies, including environmentally sound technologies. A strong

Box 5

Photovoltaics in developing countries

The World Bank and the International Finance Corporation (IFC), with planned assistance from the Global Environment Facility (GEF), are developing a Solar Development Corporation (SDC) and a Photovoltaics Market Transformation Initiative (PVMTI). SDC and PVMTI should be launched shortly after an extended period of market research. The $30 million, GEF-funded PVMTI will make multiple investments from $500,000 to $5 million in existing and new consortiums in India, Morocco and Kenya that can offer innovative packages and applications for both on- and off-grid PV power.

Source: *Financial Times* (1 October 1997), p. 11.

Box 6

University Partnership for Knowledge Sharing

The Cooperation Programme in Europe for Research on Nature and Industry through Coordinated University Studies (COPERNICUS) represents an effort to mobilize the resources of European universities committed to sustainable development and environmental management. COPERNICUS functions as a networking tool for cooperation between universities in Europe to share knowledge and expertise and be a partner for industry and governmental authorities at the local level.

Source: COPERNICUS secretariat, Institute of Environmental Research, University of Dortmund, Germany.

interest of developed country Governments in funding research on environmentally sound technologies is to strengthen the international competitiveness of their industries and to facilitate companies' compliance with environmental regulations. A growing share of government R&D funding is being allocated to private sector research to develop new technologies.

24. The meeting noted that many Governments explicitly refer in their public policy statements to the need to share environmentally sound technologies with the developing world. It appeared, however, that the extent and pace at which environmentally sound technologies were being transferred to developing countries were inadequate. New policy initiatives are required to accelerate the transfer of publicly funded environmentally sound technologies to users in developing countries and to facilitate the dissemination of such technologies in those countries. Technical cooperation and ODA should assist in the transfer of environmentally sound technologies resulting from publicly funded research by supporting developing countries in the development of the capacities to assess, adapt, use and manage environmentally sound technologies. Environmental auditing services could help in identifying priorities for technology transfer.

25. Many environmentally sound technologies exist in the public domain that remain underutilized or unutilized. To make these technologies accessible to developing countries, a number of measures could be taken. For example, information on available environmentally sound technologies could be systematically compiled and made available through existing databases. Incentives could also be introduced to encourage technology suppliers to facilitate access of potential users in developing countries to the technologies, to assess user needs and to assist in technology adaptation.

26. Governments play an important role in building and strengthening strategic alliances for the generation, commercialization and dissemination of environmentally sound technologies that are the result of publicly funded research activities. Incentives should be provided to local R&D institutions to increase the output of marketable R&D

results on environmentally sound technologies. Intermediate mechanisms need to be created and strengthened that would work directly with firms and other end-users of technology. Many intermediate steps must be undertaken before the knowledge generated in R&D institutions can be used by potential end-users of technology. Such intermediary steps include the further development of the technology, pilot phases and demonstration projects. Moreover, intermediaries are often essential to find commercialization partners for R&D institutions and to provide follow-up services to firms.

C. Developing national technology strategies

27. Developing countries should develop policies to enhance the ability of their companies to compete in an increasingly competitive world economy. Technological development is essential to that process, and developing countries should harness their technological and entrepreneurial resources to that end.

28. The relationship between technological progress and economic performance is well established. Knowledge and new ideas are the primary source of economic growth because, together with an enabling business environment that rewards entrepreneurial innovation, they lead to technological innovation and hence to productivity improvements. If not enough resources are dedicated to scientific research and technological development, the rate of economic growth will suffer. Domestic R&D capacities are the basis not only for technology generation, but also for acquiring technological know-how from abroad, and ensuring that it can be exploited domestically.[7]

29. Most developing countries have inadequate levels of human resources, industrial capacity and infrastructure. In developing national technology strategies, developing countries should concentrate on improving the productivity of domestic companies in economic sectors in which comparative advantage and technological capacities best match.

30. Policies should be designed to strengthen technological innovation and adaptation capabilities. Strong technological capacities within research institutions and universities should be complemented by mechanisms to make them sensitive to the signals of the marketplace. Policy measures should target the building of institutional networks involving R&D institutions, companies and intermediaries to ensure rapid commercialization and adaptation of technological knowledge and know-how both from domestic and foreign sources.

Notes

[1] In the context of the present report, environmentally sound technology is used as a relative concept. What might be perceived as environmentally sound today may not necessarily be so tomorrow. Moreover, any technology must be viewed in relation to the socio-economic and cultural conditions in which it is operating. A narrow definition of environmentally sound technologies seems to be neither helpful nor desirable. Discussion on this issue may benefit from a categorization of environmentally sound technologies, as attempted by the United Nations Environment Programme.

[2] See "Europe-Asia co-operation strategy in the field of environment" (COM (97)490-Final) communication from the Commission of the European Communities to the European Council, the European Parliament and the Economic and Social Committee.

[3] See the Chairman's summary of the Roundtable on Business and Sustainability, hosted by European Partners for the Environment under the patronage of the European Council and the Commission of the European Communities (Brussels, 11 February 1998).

[4] See the summary report of the Technology Cooperation Workshop, held by the United Kingdom under the auspices of the Advisory Committee on Business and the Environment (London, 10 December 1997).

[5] General Assembly resolution S-19/2, annex, para. 91.

[6] For the report of the International Expert Meeting on the Role of Publicly funded Research and Publicly owned Technologies in the Transfer and Diffusion of Environmentally Sound Technologies (Kyongju, Republic of Korea, 4-6 February 1998), see document E/CN.17/1998/12.

[7] Michael Borrus and Jan Stowsky, *Technology Policy and Economic Growth*, BRIE Working Paper No. 97 (Berkeley, California, University of California at Berkeley, April 1997), p. 2.

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Capacity-building, education and public awareness, science and transfer of environmentally sound technology

Report of the Secretary-General

Addendum

Education, public awareness and training*

(Chapter 36 of Agenda 21)

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I. Introduction

1. The present report consists of extracts from the report entitled "Educating for a sustainable future: a transdisciplinary vision for concerted action",[1] which was prepared by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as a contribution to the work programme of the Commission on Sustainable Development, which called upon UNESCO to refine the concept and key messages of education for sustainable development.[2] The document is to be seen as the beginning of a process, as an attempt to stimulate discussion and as an action-oriented paper. It reflects the new vision of education as a means to achieving a sustainable future.

II. Education: the force of the future

2. It is widely agreed that education is the most effective means that society possesses for confronting the challenges of the future and for shaping the world of tomorrow. Access to education is the sine qua non for effective participation in the life of the modern world at all levels.

3. Education must not be equated with schooling or formal education alone. It includes non-formal and informal modes of instruction and learning as well, including traditional learning acquired in the home and community. By defining education broadly, one also widens the community of educators, as the programme statement of *Education 21* promoted within the United Kingdom notes, to include teachers, lecturers, curriculum developers, administrators, support staff, industrial trainers, countryside rangers and staff, environmental health and planning officers, education officers with non-governmental organizations (NGOs), community educators, youth leaders, parent association members, media people, representatives of learners in all contexts – and yet more. One might further widen this community to include all those, whatever their role in society, who perceive a need or duty to inform and educate people regarding the requirements of a sustainable future. International organizations, government departments and institutions, foundations and many others are deeply involved in education in the broad sense of the term used here. Many firms in the private sector also see the need to play their part in promoting awareness and are doing so in innovative ways: for example, through sponsoring the publication of articles in newspapers and journals exploring environmental and social issues. This vast community of educators represents an enormously potent, but largely untapped human resource for sustainable development that can be invaluable in a range of contexts as well as education. It represents, above all, a means for bringing the struggle for sustainable development into communities and local institutions around the world, which, in the final analysis, is where the cause of sustainable development will either triumph or fail.

4. Education serves society in a variety of ways. The goal of education is to make people wiser, more knowledgeable, better informed, ethical, responsible, critical and capable of continuing to learn, and more productive and creative in the workplace. Were all people to possess such abilities and qualities, the world's problems would not be automatically solved, but the means and the will to address them would be at hand. Education also serves society by providing a critical reflection on the world, especially its failings and injustices, and by promoting greater consciousness and awareness, exploring new visions and concepts, and inventing new techniques and tools. Education is also the means for disseminating knowledge and developing skills, for bringing about desired changes in behaviours, values and lifestyles, and for promoting public support for the continuing and fundamental changes that will be required if humanity is to alter its course, leaving the familiar path that is leading towards growing difficulties and possible catastrophe, and starting the uphill climb towards sustainability. Education, in short, is humanity's best hope and most effective means in the quest to achieve sustainable development.

III. Public awareness and understanding: the fuel for change

5. Public awareness and understanding are, at once, consequences of education and influences on the educational process. A public well informed of the need for sustainable development will insist that public educational institutions include in their curricula the scientific and other subject matters needed to enable people to participate effectively in the numerous activities directed towards achieving sustainable development. Common information and shared understandings are therefore important not only for mobilizing public support, but also for carrying out consultative work and participatory approaches in all fields.

6. An approach that emphasizes local issues, rather than global ones, is often more effective in promoting public interest and understanding. This may account, in part, for the success of non-formal community education and local environmental communication programmes in reaching and sensitizing people to environmental and development issues in both developing and industrialized countries. A particular

benefit of such programmes is that they are often directly linked to action to control or solve the problems identified.

IV. The need for effective communication

7. One of the lessons of recent experience is the need to establish effective communication strategies as an integral part of any major scientific inquiry or programme. Communication has to be seen as a long-term interactive process strategically aimed at particular groups and audiences, not as a concluding message when a project or panel is about to present its final report and wind up its activities. It is not necessary – or even desirable – for scientists to become propagandists, but it is essential that studies conducted in the public interest have adequate means to communicate their findings to the public on whose behalf they were carried out.

V. Confronting vested interests

8. Until quite recently, advocates of the common interest have had difficulty mustering the needed public relations expertise and support to overcome the influence of vested interests. Fortunately, in the past two decades, many lessons have been learned, especially by environmentalists, on how to convert a growing public concern for the state of the Earth into effective support for specific measures to address concrete problems. Yet, in most countries, while environmental issues are now receiving greater support, measures aimed at promoting population policies, social development, poverty reduction and other necessary measures for achieving sustainable patterns of development continue to be largely ignored by the general public. Ultimately, though, there can be no solution to environmental problems unless the social and economic ills besetting humankind are seriously addressed. It is this broader message and reality which remains to be effectively communicated to and internalized by the public. A vigilant and informed world public represents a powerful counterweight to the vested interests that appear, at present, to have the upper hand on many issues.

VI. Complex messages

9. The messages of sustainable development represent a challenge in and of themselves. Rather than being simple and unambiguous – thus easy to communicate – environmental and developmental issues tend to be complex. This is so because of the inherent complexity of ecological and human systems. They defy simplistic explanations, solutions and predictions. Complex realities are difficult to communicate in simple messages. Yet, attempts to simplify what, by its very nature is not simple, may result in further confusion and misunderstandings and, ultimately, in lack of credibility.

10. The same problems arise, although to a lesser degree, in dealing with major transformations such as population growth and urbanization. People have difficulty adjusting from the scale of things encountered in everyday life to the scales of magnitude – enormously large and infinitesimally small – needed to understand demographic or ecological phenomena. Ultimately, a solution can be found only by educating the public in the developmental and environmental "facts of life". Indeed, in the twenty-first century, the literacies of science, ecology and development will be as essential to comprehending the world as were the traditional skills of reading and writing at the start of the present century.

11. In the meantime, it will be important for those advocating sustainable development to choose, wherever possible, those cases and examples that are most easily understood by the general public. The basic dictum of pedagogy is to begin where the learner is. This is also good advice for the communication specialist. Start with problems that people feel and understand at the local level. That is both valuable knowledge in itself and, if need be, a basis for moving on to more complex and global understandings.

VII. The messengers

12. Emotionalism and exaggeration are another frequent source of difficulty. The press is understandably drawn to those with the most extreme views. Disagreements and conflicting views between specialists are also "newsworthy" and are skilfully exploited. More moderate and reasoned voices often go unheard in the din. Extreme positions, while they may be useful in catching the public s attention and alerting it to pending dangers, make it difficult to move from declarations and debate into action.

13. It has to be recognized that neither individuals nor societies are ready or even able to change their habits and behaviours from one day to the next. Proposals for change, if they are to be effective, have to be feasible. Both the messages and the messengers have to appear credible and

responsible. Alarmist predictions that make it seem that the world is about to end are evidently not conducive to the long-term planning and action that sustainable development requires. On the contrary, it is far more effective to present problems as manageable through responsible conduct and, wherever possible, put forward a realistic solution and a means to take preventive action.

VIII. Reorienting education to support sustainability

14. Reorienting education to sustainability requires recognizing that traditional compartments and categories can no longer remain in isolation from each other and that we must work increasingly at the interface of disciplines in order to address the complex problems of today's world. This is true both within education, where interdisciplinarity is slowly and with difficulty gaining ground, and between the spheres of education, work and leisure as lifelong learning emerges as a key concept for planning and developing educational systems. These changes are not occurring nearly as rapidly as would be desired, but they are nonetheless taking shape within education at all levels.

15. Ultimately, sustainable development will require an education that not only continues throughout life, but is also as broad as life itself, an education that serves all people, draws upon all domains of knowledge and seeks to integrate learning into all of life's major activities. The rapid growth of knowledge has rendered the notion of schooling as a "once and for all" preparation for life utterly obsolete. The growth of knowledge is advancing exponentially, yet not nearly as fast as the need for understanding and solutions at which it is aimed. As concerns sustainable development specifically, it is impossible to predict with reliability what will be the key issues on which people will need information in 5, 10, 20 or 50 years. It is predictable, however, that such developments will not fit neatly into the existing and artificial subdivisions of knowledge that have been in place for more than a century. Hence, understanding and solving complex problems is likely to require intensified cooperation among scientific fields as well as between the pure sciences and the social sciences. Reorienting education to sustainable development will, in short, require important, even dramatic changes, in nearly all areas.

16. In the sections that follow, a number of key issues relating to the role of education in sustainable development will be briefly examined.

IX. Importance of basic education

17. Inherent in the concept of sustainability is the vision of a more equitable world. This can only be achieved by providing the disadvantaged with the means to advance themselves and their families. And of these means, the most essential is education, particularly basic education. Over 100 million children between the ages of 6 and 11 never attend school and tens of millions more enter school only to drop out within a few months or years. Moreover, there are over 800 million illiterate adults, most of whom have never been enrolled in school. The first requirement in the quest for development and equity must be to change this situation and make schooling of quality available to all. But that goal, alas, is still far off. For the present, the challenge is to make the best of an unfortunate and unjust situation.

18. Given the situation today in many developing countries, it does not suffice to orient formal education towards sustainability. Attention also has to be given to those who are at present unserved or poorly served by schools. This is a large group, well over a billion people, and a vital one for the future. Girls and women, the mothers of today and tomorrow, are in the majority. They are, or will be, the first and most influential teachers of their children. The goals of educating young children are focused on ensuring their health, development, happiness, well-being and adjustment to the environment in which they live.

19. Basic education is aimed at all the essential goals of education: learning to know, to do, to be (i.e., to assume one's duties and responsibilities) and to live together with others, as outlined in *Education: the Treasure Within*, the report of the Independent Commission on Education for the Twenty-first Century, published in 1996 by UNESCO.

20. Basic education provides the foundation for all future education and learning. Its goal, as concerns those in the pre-school primary school-age population, whether enrolled in school or not, is to produce children who are happy with themselves and with others, who find learning exciting and develop inquiring minds, who begin to build up a storehouse of knowledge about the world and, more important, an approach to seeking knowledge that they can use and develop throughout their lives. Basic education for adults is aimed at empowerment by enabling people to participate in shaping a sustainable future. Basic education is, thus, not only the foundation for lifelong learning, but also the foundation for sustainable development.

X. Changes required in formal education

21. Education plays a dual role, at once both reproducing certain aspects of current society and preparing students to transform society for the future. These roles are not necessarily mutually exclusive. However, without the commitment of all of society to sustainable development, curricula have tended in the past to reproduce an unsustainable culture with intensified environment and development problems rather than to empower citizens to think and work towards their solution. The role of formal education in building society is to help students to determine what is best to conserve in their cultural, economic and natural heritage and to nurture values and strategies for attaining sustainability in their local communities while contributing at the same time to national and global goals.

A. Curriculum reform

22. To advance such goals, a curriculum reoriented towards sustainability would place the notion of citizenship among its primary objectives. **This would require a revision of many existing curricula and the development of objectives and content themes, and teaching, learning and assessment processes that emphasize moral virtues, ethical motivation and ability to work with others to help build a sustainable future.**

23. **This kind of orientation would require, *inter alia*, increased attention to the humanities and social sciences in the curriculum.** The natural sciences provide important abstract knowledge of the world but, of themselves, do not contribute to the values and attitudes that must be the foundation of sustainable development. Even increased study of ecology is not sufficient to reorient education towards sustainability. Even though ecology has been described by some as the foundation discipline of environmental education, studies of the biophysical and geophysical world are a necessary – but not sufficient – prerequisite to understanding sustainability. The traditional primacy of nature study, and the often apolitical contexts in which it is taught, need to be balanced with the study of social sciences and humanities. Learning about the interactions of ecological processes would then be associated with market forces, cultural values, equitable decision-making, government action and the environmental impacts of human activities in a holistic interdependent manner.

24. **A reaffirmation of the contribution of education to society means that the central goals of education must include helping students learn how to identify elements of unsustainable development that concern them and how to address them.** Students need to learn how to reflect critically on their place in the world and to consider what sustainability means to them and their communities. **They need to practise envisioning alternative ways of achieving development and of living, evaluating alternative visions and more sustainable consumption and production patterns, learning how to negotiate and justify choices between visions, making plans for achieving desired ones, and participating in community life to bring such visions into effect.** These are the skills and abilities which underlie good citizenship, and make education for sustainability part of a process of building an informed, concerned and active populace. In this way, education for sustainability contributes to education for democracy and peace.

B. Structural reform

25. **Reorienting the curriculum towards sustainable development requires at least two major structural reforms in education. The first is to re-examine the centralized mandating of courses and textbooks in order to allow for locally relevant learning programmes.** Local decision-making can be facilitated through the reform of centralized educational policies and curricula, and the formulation of appropriate syllabuses and assessment policies. Nationally endorsed syllabuses can serve as "broad framework documents" that provide aims and general objectives for subjects, an overview of broad content themes, appropriate learning experiences, relevant resource materials, and criteria for assessing student learning. This type of syllabus can provide centralized accountability, while allowing schools, teachers and students to make choices about the specific learning experience, the relative depth and breadth of treatment for different topics, the case studies and educational resources used, and how to assess student achievements.

26. A second major area of structural reform is the development of new ways to assess the processes and outcomes of learning. Such reform should be inspired by what people want from their educational system, as well as what society needs. The period of profound change in which we are living needs to be taken into account by educational systems, which were, for the most part, designed to serve a society that is fast becoming history. Learning needs to be seen as a lifelong process that empowers people to live

useful and productive lives. The reorientation of education along these lines – and in anticipation to the extent possible of future needs – is fundamental for sustainable development, including its ultimate objective not only of human survival but especially of human well-being and happiness. **Similarly, there also needs to be a revamping of the methods of credentialing students. The various ways in which students are judged (testing, report cards, evaluations) and the basis for awarding diplomas at all levels need to reflect the reformulation of outcomes of learning towards sustainability.**

XI. Contribution of environmental education

27. It is clear that the roots of education for sustainable development are firmly planted in environmental education. While environmental education is not the only discipline with a strong role to play in the reorienting process, it is an important ally. In its brief 25-year history, environmental education has steadily striven towards goals and outcomes similar and comparable to those inherent in the concept of sustainability.

28. In the early 1970s, the emerging environmental education movement was given a powerful boost by the United Nations Conference on the Human Environment, held in Stockholm in 1972, which recommended that environmental education be recognized and promoted in all countries. This recommendation led to the launching in 1975 by UNESCO and the United Nations Environment Programme (UNEP) of the International Environmental Education Programme (IEEP), which continued until 1995. The influence of the IEEP – and the national and international activities that it inspired – has been widely felt and is reflected in many of the educational innovations carried out in the last two decades.

29. That work was inspired largely by the guiding principles of environmental education laid down by the Intergovernmental Conference on Environmental Education, held in Tbilisi in 1977. The concepts and vision taken up at the Conference encompass a broad spectrum of environmental, social, ethical, economic and cultural dimensions. Its basic principles were successfully translated into educational goals and, with greater difficulty, into schoolroom practice in many countries. It is therefore not surprising that many recommendations of the United Nations Conference on Environment and Development, held in Rio de Janeiro 15 years later, echo those of Tbilisi.

30. The motto of the environmental education movement has been: "think globally, act locally". Over a period of more than two decades, it developed a highly active pedagogy based on this premise. In the early grades, in particular, the emphasis was upon learning the local environment through field studies and classroom experiments. By starting in the primary grades, before the process of compartmentalization that marks secondary and particularly higher education sets in, students were encouraged to examine environmental issues from different angles and perspectives.

31. The influence of environmental education in promoting interdisciplinary inquiries can be seen at all levels of education. A course on environmental economics, for example, looks to anthropology for insights and source material. Environmental education has also found original ways of looking at and measuring human impact on the environment, such as the "ecological footprint", which estimates the number of acres of land required to sustain individuals according to their lifestyles and patterns of consumption. Innovative work has also been done in the field of environmental health by relating illness to environmental stress and ways of life.

32. In brief, the record of the environmental education movement is one of resourcefulness, innovation and continuing accomplishments. Lessons learned from environmental education provide valuable insight for developing the broader notion of education for sustainable development.

XII. Interdisciplinarity

33. Education for sustainability calls for both interdisciplinary inquiry and action. It does not, of course, imply an end to work within traditional disciplines. A disciplinary focus is often helpful, even necessary, in allowing the depth of inquiry needed for major breakthroughs and discoveries. But increasingly, important discoveries are being made not within disciplines, but on the borders between them. This is particularly true in fields such as environmental studies, which are not easily confined to a single discipline. Despite this realization and a broadening support for interdisciplinary inquiries, the frontiers between academic disciplines remain stoutly defended by professional bodies, career structures and criteria for promotion and advancement. It is no accident that environmental education and, more recently, education for sustainable development, has progressed more rapidly at the secondary and primary levels than within the realm of higher education.

34. Yet, higher education has an indispensable role to play. This is true both in the area of research and in the training of specialists and leaders in all fields. It is, for example, increasingly important to include appropriate materials on sustainable development in the programmes of study of journalists, engineers, managers, doctors, lawyers, scientists, economists, administrators and numerous other professions. Universities could also render a valuable service by building components of sustainable development into the special programmes for teachers, senior managers, local leaders such as mayors, parliamentarians and others in leadership positions. Universities also play a key role in international cooperation and would do so more effectively if they gave fuller consideration to the needs of scientists and social scientists from developing countries, especially as concerns interdisciplinary inquiries into environment and development issues.

XIII. Culture and sustainability

35. Culture shapes the way we perceive the world and how we interact with it. To the extent that the global crisis facing humanity is a reflection of our collective values, behaviour and lifestyles, it is, above all, a cultural crisis. For all the people of the world, culture is a very practical, concrete determinant of sustainable development. The kind of change required by sustainability at the level of community, household or individual will need to be rooted in the cultural specificity of the town or region if the people are to be supportive of and involved in such change.

36. It is in this context that education and public awareness are seen as essential to bringing about conditions conducive to sustainable development. Ethical values, such as equity, are shaped through education, in the broadest sense of the term. Education is also essential in enabling people to use their ethical values to make informed and ethical choices. Over time, education also powerfully affects cultures and societies, increasing their concern over unsustainable practices and their capacities to confront and master change. Indeed, the potential of education is enormous. Not only can it inform people, it can change them. It is not only a means for personal enlightenment, but also a means for cultural renewal. Education not only provides the scientific and technical skills required, it also provides the motivation, justification and social support for pursuing and applying them. Education increases the capacities of people to transform their visions of society into operational realities. It is for this reason that education is the primary agent of transformation towards sustainable development.

XIV. Mobilizing for action

37. While sustainability is a long-term goal for human society and a process that will necessarily need to take place over time, there is a sense of urgency to make progress quickly before time runs out. Humanity is therefore faced with a tremendous challenge, a challenge of unprecedented scope, scale and complexity. One is pressed to act even as new concepts and new methodologies are still being worked out. One is pushed to change structures and mindsets, yet there is no obvious path, no model that shows the way. Experimentation and innovation are the watchwords, as we search – often simply through trial and error – for adequate solutions. And one must do all this in a climate of sweeping economic, social and political change, while being exhorted to "do more with less".

XV. International framework for action

38. There is an internationally negotiated framework for action that has been hammered out during the series of United Nations conferences dealing with different aspects of sustainable development, beginning in 1992 with Rio (environment and development), and followed in 1994 by Cairo (population), in 1995 by Copenhagen (social development) and Beijing (women), and in 1996 by Istanbul (human settlements). Each of these conferences, as well as the three conventions on biological diversity, climate change and desertification, contain explicit recommendations or whole chapters devoted to education and public awareness. The international consensus that these agreements represent is a solid and comprehensive basis for moving forward.

39. At the heart of this new international consensus is a new vision of education, public awareness and training as the essential underpinning for sustainable development, a linchpin to support advances in other spheres, such as science, technology, legislation and production. Within the action plans, education is no longer seen as an end in itself, but as a means to:

- Bring about the changes in values, behaviour and lifestyle that are needed to achieve sustainable development, and ultimately democracy, human security and peace;
- Disseminate knowledge, know-how and skills that are needed to bring about sustainable production and consumption patterns and to improve the management of natural resources, agriculture, energy and industrial production;

- Ensure an informed populace that is prepared to support changes towards sustainability emerging from other sectors.

40. **There is an increased emphasis on integrated follow-up to these action plans. As far as education, public awareness and training are concerned, chapter 36 of Agenda 21 provides an umbrella framework for such integration.** The implementation is to be undertaken not only for international institutions such as the United Nations system, but also and most importantly by national and local entities. A range of major groups – including women, youth, farmers, parliamentarians, scientists, business and industry and others – are called upon to participate, as well as Governments and non-governmental organizations at all levels.

XVI. Action at the national level

41. **It is at this level that overall strategies for sustainable development must be given clarity and impetus and the need to integrate education into them in creative and effective ways recognized and acted upon.** This involves the national Government – which has the leadership role – major NGOs and associations, citizens groups, including corporate citizens, and educational and other specialized institutions. Also involved are the agencies and organizations of the United Nations system, which are endeavouring to work closely with national authorities in implementing the recommendations of the various international conferences that have pointed the way towards sustainable development. **The media – including the most modern and traditional ones, should also be engaged to explain the purposes and goals of programmes and in making government plans and action known to the public.**

42. **Governments should play a leading role in explaining the vision and benefits of sustainable development to the public.** They should do so through all means available, public and private. **The national school curriculum, at all levels, must incorporate the messages of sustainable development. These messages must also be emphasized in pre-service and in-service programmes of teacher training. Specialized institutions of all sorts should be actively involved.** The relationship between environmental factors and health problems, for example, should be explained by doctors, nurses and hospitals.

43. It is essential that national leaders demonstrate that there is political will to give priority to sustainable development and that they see public awareness-raising and education and training as essential means for achieving national objectives. **Government leaders have to translate the concept of sustainable development into clearly definable steps and goals. Such goals should be set for every sector. There should, for example, be a clear timetable for reorienting the education system with the necessary budget and resources to achieve the goal.** In many countries, national strategies or plans for sustainable development are instrumental in mobilizing and focusing efforts around national priorities. Similar plans also exist at the level of some regions and subregions.

44. **The civil society at all levels, especially the national, should express its support for vigorous action aimed at advancing towards sustainable development.** Organizations with specialized interests and competencies should not only support government actions, but should also monitor and assess them within their areas of competence and keep the public informed of both progress and problems. **Teachers associations, for example, should carefully assess the progress being achieved in reorienting the education system towards sustainability and should keep both their members and the public-at-large informed of the situation.**

45. **At the local level, the meaning and vision of sustainable development should be disseminated, discussed and debated in order to promote understanding and win community support. These discussions should take place in all community settings and institutions, including in schools.**

46. The need for sustainable development at the local level must be understood. Practices that are not sustainable should be identified. Possibilities for correcting them can then be discussed and explored. It is critically important that the entire community, especially women, be involved in this discussion. Women, especially in rural communities, usually play a key role in the economic as well as in the social and cultural aspects of life. **The local community and the household are important entry points for messages on sustainable development, especially for adults and out-of-school children. The schools, too, at all levels, should be actively involved in both discussions about and action to achieve sustainable development and should keep both their members and the public-at-large informed of the situation.**

Notes

[1] EPD-97/CONF.401/CLD.1; available from UNESCO in Arabic, Chinese, English, French, Portuguese and Spanish in printed form or on the Internet (http://www.unesco.org).

[2] See *Official Records of the Economic and Social Council, 1996, Supplement No. 8* (E/1996/28), chap. I, sect. C, decision 4/11.

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Progress in the implementation of the programme of action for the sustainable development of small island developing States

Report of the Secretary-General*

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* The present report has been prepared by the Department of Economic and Social Affairs of the United Nations Secretariat. It is based on reports on nine programme areas of the Programme of Action, which have been issued as addenda 1-9 to the report. The addenda were prepared in accordance with arrangements agreed to by the Inter-Agency Committee on Sustainable Development, and were the result of consultation and information exchange between United Nations agencies, interested government agencies and a range of other institutions and individuals.

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I. Introduction

1. At its fifth session, in 1997, the Commission on Sustainable Development adopted resolution 5/1, which was endorsed by the General Assembly at its nineteenth special session. In that resolution, the Commission requested its secretariat, with the assistance of the Inter-Agency Committee on Sustainable Development (IACSD) task managers, to prepare reports on all the outstanding chapters of the Programme of Action for the Sustainable Development of Small Island Developing States for consideration at its sixth session, in 1998. The present report and the nine addenda on which it is based (E/CN.17/1998/7/Add.1-9) have been prepared in response to that request. The present report summarizes the major findings and recommendations contained in the addenda. It does not reiterate the basis for action and recommendations contained in the Programme of Action but is meant to supplement the Programme of Action in the light of new findings and experience that have arisen in the course of its implementation. The recommendations for action provided in the present report, if implemented, would give greater effect to those contained in the Programme of Action.

II. Climate change and sea level rise

A. Major additional findings

2. There are varying degrees of national-level efforts within small island developing States. Most small developing islands have ratified the United Nations Framework Convention on Climate Change and are making efforts to comply with its provisions through a series of measures. Some are undertaking studies of greenhouse gas sources and sinks, with assistance from regional and international organizations. Broad strategic directions related to climate change are included in the national strategies for sustainable development of many small island developing States. In some cases, specific policies or strategies for climate change are being developed, with the assistance of regional and international organizations; in others, they are being integrated into coastal management plans. In a number of small island developing States, climate data-collection systems have also become operative. So far, however, little work has been undertaken to develop detailed plans for adaptation to climate change and sea level rise at the national level. Ongoing work to determine vulnerability to climate change and to meet national reporting obligations under the Convention will provide the essential foundation for such plans.

B. Recommendations for action

1. National level

3. Incorporate all considerations, in particular adaptation strategies relating to climate change and sea level rise in long-term development planning processes.

4. Build adequate human resource and institutional capacity to absorb and adapt the findings of the current projects on planning for adaptation to climate change and sea level rise that are currently under implementation in some small island developing States, and take preventive and remedial measures in order to minimize and mitigate the impacts of climate change and sea level rise.

2. Regional level

5. Establish effective institutional capacity for all small island developing States regions to undertake activities related to the modalities of effective and efficient adaptation to climate change and sea level rise. Where such capacity exists, they need to be further strengthened.

6. Implement projects on planning for adaptation to climate change in all small island developing States regions, with the provision to sustain them on a long-term basis, and help to develop the scientific and technical capacity of small island developing States to formulate and implement effective strategies and policies to minimize or mitigate the impacts of climate change and sea level rise. Where such activities have been initiated, they must be sustained.

3. International level

7. Facilitate further research on the regional and temporal responses of sea level rise that takes account, if possible, of changes in the frequency, intensity and location of higher-frequency and smaller-scale phenomena.

8. Facilitate further research on the contributions of ice sheets, glaciers and land and ground water storage to sea level change.

9. Provide adequate financial and technical assistance to help small island developing States to build human-resource and institutional capacity at the national and regional levels to cope with the impacts of climate change and sea level rise, and supplement, as necessary, the resources of the relevant regional small island developing States institutions

responsible for implementing projects on adaptation to climate change and sea level rise.

10. In addition, facilitate the establishment of an observing system for generating data sets to improve model predictions of climate change and to help direct future impacts on small island developing States. Such a system should include (a) a high-accuracy altimeter to measure spatial variations and monitor temporal variability and trends in sea level rise; (b) sufficient (about 30) open-ocean gauges to monitor and eliminate trends in the altimeter; (c) globally distributed set of gauges for sampling at the margin of the altimeter (including coastal regions and high latitudes); (d) geodetic positioning to improve reference levels of *in situ* gauges; (e) improvements in the World Weather Watch Network to address small island developing States meteorological data gaps.

III. Management of wastes

A. Major additional findings

11. To date, there have been no concerted attempts to develop integrated and comprehensive approaches to waste management strategies in most small island developing States. The concept of waste separation and recycling is still in its early stages, though some attempts have been made to reduce the amounts of wastes generated. Many small island developing States have yet to ratify the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

12. There are very few sanitary landfills in small island developing States. A large proportion of industrial and hazardous wastes continues to be disposed of in the municipal solid waste stream or even dumped without any control, though this may be prohibited by law. Leakages are quite common. Only a fraction of wastewater is treated before being discharged into the surrounding land and water resources. A lack of technical and financial capabilities to operate and maintain the existing facilities for sewage treatment makes it difficult to control wastewater. Solid and liquid wastes generated from ships and the resulting pollution are of considerable concern to small island developing States, but no perceptible progress has been made in building port reception facilities for accepting ship-borne wastes or for avoiding oil spills in ports. A few international and regional initiatives have been taken, but much remains to be done for the protection of the marine environment and for development.

13. Suitable financial planning for the entire cycle of waste management has not been well developed in most small island developing States, resulting in severely underfunded operations and a shortage of proper facilities and trained operators. One of the most disturbing aspects is the lack of financial autonomy of waste management institutions. Where waste management departments are self-financing, the revenue generated is often used for other purposes. Tools for mobilizing financial resources, such as government budgetary allocations, charge systems and other relevant economic instruments, have yet to be developed and included as core elements of financial strategies.

B. Recommendations for action

14. Further efforts are needed at all levels to implement the actions, policies and measures identified in the Programme of Action. Higher priority should be given to the economic and financial aspects of waste management. Revenue-generating policies for improving the financing of waste-management facilities should be seriously considered by regional and local governments in small island developing States. Specific priority actions which could give effect to the objectives of the Programme of Action at the national and regional levels could include:

(a) Improve landfill management, including by selecting optimal technologies and financial mechanisms, such as landfill charges and other levies. The management plan should also encompass operational requirements with appropriate guidelines/standards, including capacity-building, regular monitoring and measures to be taken in the closure of landfills;

(b) Separate industrial wastes, particularly hazardous wastes, from domestic waste and dispose of them properly. Inventories of industrial waste, pollutants and hazardous waste and code of practice need to be introduced for environmentally sound industrial operations in small island developing States, modified as appropriate for local use, in close cooperation with regional and international bodies;

(c) Secure suitable long-term storage facilities for hazardous waste and identify suitable final disposal options;

(d) Where they have been introduced, efforts are needed to improve the efficiency of septic tank systems. Sound practices leading to the incorporation of septic sludge into local agricultural and forestry operations should be developed and disseminated;

(e) Environmental impact assessments should be made mandatory for all projects related to waste disposal.

IV. Freshwater resources

A. Major additional findings

15. Small islands have limited options when developing their freshwater resources. The relatively short length of freshwater circulation in small islands limits the methods available to utilize them. To maintain surface and groundwater circulation requires regular recharge events. The geophysical settings of many small island developing States make them vulnerable not only to extreme climatological and seismic events, but more critically to unpredictable periods of low recharge. On volcanic piles with rapid baseflow recession and on atoll islands with thin freshwater lenses, hydro-environmental limits in terms of water quantity and quality are reached very quickly in periods of low recharge. Moreover, many small island developing States have few or no permanent streams or lakes. They have limited capacity to store water for use during the dry season. Building large reservoirs in small island developing States can flood large areas of their relatively scarce land area. Furthermore, steep topography, short river channels and easily erodible soils can cause siltation of reservoirs, further decreasing their capacity for water storage.

16. As a result, many small island developing States depend heavily on groundwater resources, which often exist in the form of freshwater "lenses" that contain limited quantities of water. Water withdrawals at rates that exceed sustainable replenishment can result in saline intrusion, thereby damaging or destroying freshwater lenses. Sea-water intrusion into small island developing States groundwater resources is obviously a serious problem, given that they are surrounded on all sides by marine water. The relative fragility of the hydrological cycles in small island developing States necessitates careful planning and development of freshwater resources in order to work within these hydro-environmental limits.

17. The water quality problem in small island developing States is aggravated by the disposal of partially treated or untreated domestic and industrial effluents into the sea. Indiscriminate disposal into near-shore environments with poor flushing to the open sea has reduced coastal water quality, particularly near large coastal settlements. As chemical and organic pollutants become more pervasive, the impact on marine environments is becoming evident, and long-term accumulation of pollutants in marine ecosystems is threatening biodiversity and local fishing industries. Pollution of marine resources from land-based activities is also a critical issue for small island developing States because they are frequently subject to torrential rains. Combined with steep topography and short river channels, this results in storm-generated run-off, including industrial wastes, mining drainage and domestic wastes, into surrounding coastal waters.

18. High water consumption by tourists and consequent production of wastewater, particularly in coastal settings, poses problems for liquid and solid waste disposal in coastal aquifers or atoll freshwater lenses. Indeed, the marketing of small island developing States as "sun, sea and sand" paradises has resulted in many hotels being built on or near beach areas, thereby concentrating waste-producing establishments near coastal waters.

B. Recommendations for action

19. Small island developing States need an integrated approach to strengthening institutions, including ministries and departments that can fundamentally affect their environmentally sustainable management and use of water resources. Cross-sectoral collaboration between land and water planning should be actively promoted, and the effectiveness of environmental agencies to monitor and enforce good spatial planning practices in fragile upland and coastal zones needs to be enhanced. The diminutive size of small islands means that sustainable socio-economic development and the needed natural resource base, including water resources, are interdependent. Thus, management and use of freshwater, coastal and marine resources should be undertaken within an institutional framework that considers linkages with the sources of potential impacts on those resources.

20. Small island developing States often need island-specific or regional studies to identify and assess their water resources, and to implement effective development and management programmes. To that end, some regions have organizations so that small island developing States can share their technical expertise and experience with each other. Establishment of relevant institutions, where needed, is one means of facilitating such exchange. One existing example is the Pacific Water and Waste Association. It would also be helpful to encourage linkages between small island developing States and bigger archipelagic countries, such as Indonesia, Malaysia and the Philippines, which have development programmes for their island provinces.

21. Efficient management and use of appropriate technologies can conserve and protect limited water resources. Further efforts are required to implement policies

for promoting efficient water services and the efficient use of and protection of available water resources. As an illustrative example, Maldives has made it mandatory for all new houses to have rainwater harvesting facilities. Demand management and leak detection can help to conserve the existing resource base. Proactive programmes of waste management and waste minimization can help to protect the resource base, but they also need to be linked to land management policies if they are to be effective.

22. Technologies more appropriate for small island developing States, such as rainwater harvesting, infiltration galleries to skim freshwater lenses and the use of low yielding solar pumps, need to be promoted to avoid last resort solutions, such as desalination.

23. The further identification and application of cleaner production methodologies that are suited to the specific development and resource needs of small island developing States should also be priority activities. These should include cleaner practices and technologies for the efficient use of water resources in all industries, particularly hotels and tourism facilities.

24. The unique characteristics of small island developing States call for urgent efforts to develop (a) self-sufficient facilities to handle solid waste, sewage and wastewater, and (b) facilities for the prevention of groundwater contamination.

V. Land resources

A. Major additional findings

25. Land pressures in some small island developing States have been further worsened by the intensification of animal farming, particularly high-input production chains. The persistence of unsustainable agricultural practices continues to contribute to deforestation in several small island developing States. A number of small island developing States are affected by changes in cropping patterns, with consequent losses of biodiversity across the landscape, loss of soil fertility, and agrochemical pollution of soils, freshwater and coastal resources downstream. Furthermore, land tenure policy in some small island developing States and other policy issues in all of them critically affect land management, as do a multiplicity of socio-economic factors, such as trade and the influence of outside markets, traditional and cultural practices, and demographics. Small island developing States rarely have an extensive and stable cadre of professional expertise, so that there is a lack of information on land resources, appropriate tools, best practices and technologies for implementing sustainable land use options and for making informed policy decisions.

B. Recommendations for action

1. National level

26. Critical efforts to better address land resources include the need to better understand land use objectives, land use options and trade-offs between uses, the need for institutional collaboration and coordination of ministries, the need to implement land dispute resolution systems and the need to use technologies as a basis for land use decision-making.

27. Institutionally, there is a need to take an intersectoral approach to addressing the complex issues of land resources wherever that is not already being done, which will entail the adoption of an integrated planning process with enhanced collaboration on the part of the Government and all relevant non-governmental stakeholders so as to make the best use of the comparative advantage of each.

28. Numerous tools, approaches, techniques and guidelines have been developed by relevant United Nations and non-United Nations organizations that small island developing States can take advantage of to address issues of land resources. A number of those modalities are currently being utilized or tried in individual small island developing States. There is a need, however, for training in the use and institutionalization of such tools, approaches and guidelines in all small island developing States.

29. Natural resource conservation should be strongly promoted by rehabilitating traditional attitudes and value systems, and by making people aware of the finite and fragile nature of those resources in today's conditions, particularly in small island developing States.

2. Regional level

30. Mechanisms must be put in place to enhance the communication networks that have been developed, as well as to develop those that are still needed. Recognizing the complexity and diversity of the natural resource management task, and the difficulty and financial burden associated with the provision of the required multidisciplinary teams of professionals in each country, the establishment of an appropriate regional mechanism within one of the existing regional organizations might be considered. Such a mechanism would provide resource management services to small island Governments, make available skills and

experience that would be much more difficult to build at national level, and facilitate the transfer and sharing of technical information and research results.

31. Effective coordination of measures designed to foster an integrated approach to the planning and management of land resources by regional institutions, including universities and relevant international programmes or initiatives, should be encouraged in all small island developing States regions where such measures have not yet been taken.

3. International level

32. International agencies and organizations must better coordinate their efforts in assistance to small island developing States; assist in the strengthening and support of regional networks; facilitate the adoption and implementation of appropriate integrated planning processes for natural resources as a means of ensuring their sustainable use; provide technical assistance in support of information systems for effective decision-making regarding land resources, as well as to assess and revise national legislation, if needed; implement appropriate training programmes; and facilitate the application of databases in integrated land use planning and management.

VI. Biodiversity resources

A. Major additional findings

33. The biodiversity of small island developing States continues to be seriously threatened by a combination of natural and anthropogenic factors. Effective conservation and sustainable use of small island developing States biodiversity entails the sustainable management of genetic resources for food and agriculture, forestry, fisheries and aquaculture, which may call for a "farming" systems approach. For forestry and capture fisheries, it implies adopting an environmentally sound and socially beneficial management approach, integrated with other land and water management strategies. Community-based management systems and related land and fishing rights in supporting food production systems are important as a basis for applying this approach. Urgent implementation of relevant regional and international agreements is particularly important for the sustainability of the fishery resources that migrate through or straddle areas of the natural jurisdiction of small island developing States.

34. To curb rapid loss of biodiversity, deforestation caused by agricultural expansion and overharvesting of forests must be controlled to reverse the continuing serious environmental consequences of lost tree cover and downstream impacts on marine areas. For sustainable forest use, the remaining forest areas of most small island developing States require immediate attention, including possible reorganization of the entire logging industry sector. Deforestation must be minimized through a coordinated policy for effective use and conservation of the remaining forest resources. In erosion-prone areas, farmers must be encouraged to adopt appropriate agro-forestry practices, which also should become an established component of integrated rural development.

B. Recommendations for action

1. National level

35. Further efforts are needed at all levels to implement the actions, policies and measures identified in the Programme of Action. Moreover, additional measures are also needed to:

(a) Build national technological and human capacity for managing natural resources, and upgrade national capabilities for marine and terrestrial resource surveys, by training key personnel and implementing measures to retain their services within the public sector;

(b) Introduce charges for using sea lanes and straits to internalize part of the costs of small island developing States biodiversity losses arising from inappropriate practices, such as waste discharges, incineration or accidental spills in proximate national or international waters. Charges and taxes on enterprises for discharges of inadequately treated wastes, taking into account the potential biodiversity losses resulting from such practices, could also be considered;

(c) Strengthen national capabilities to maintain agro-biodiversity, including animal and plant protection and quarantine services through assessment and strengthening of national legislation, facilities and services, including surveillance;

(d) Enhance farming systems and improve management of natural resources, as applicable, rehabilitate degraded habitats, where appropriate, and monitor the impact of development programmes, including the impact of introduced species on native ecosystems, and the success of rehabilitation efforts;

(e) Evaluate and modify – if necessary – and implement existing guidelines and codes of practice on best practices in farming systems and species introduction.

2. Regional level

36. Measures are also needed to:

(a) Strengthen regional activities for harmonizing legislation and promoting the exchange of technologies and expertise;

(b) Strengthen the capacity of regional bodies to undertake surveys on reef, estuary, wetland and lagoon resources, and monitor and promote innovative coral reef and mangrove programmes.

3. International level

37. Measures are also needed to:

(a) Assist small island developing States in developing inventories of marine biodiversity resources and in strengthening regional and marine research centres;

(b) Support participation of small island developing States representatives in relevant global negotiation processes, including in meetings of the Convention on Biological Diversity, especially the Conference of Parties to the Convention and its Subsidiary Body on Scientific, Technical and Technological Affairs, and in expert and liaison groups, to ensure appropriate consideration of small island developing States priorities;

(c) Support small island developing States in strengthening national and regional capabilities for conservation and the sustainable use of genetic resources for food and agriculture, including the implementation of priorities identified in the Global Plan of Action for Plant Genetic Resources adopted at Leipzig in 1996;

(d) Provide technical assistance to assess and revise, where needed, national legislation, implement appropriate training, and enhance database development and technology transfer. Countries that import small island developing States animal and plant resources should be encouraged to assist small island developing States in upgrading their facilities and strengthening animal and plant protection and quarantine services to ensure the achievement of international standards.

VII. National institutions and administrative capacity

A. Major additional findings

38. Most small island developing States Governments have taken important initiatives to strengthen national institutions and administrative capacity. Many of them have established high-level bodies charged with the overall responsibility for guiding and coordinating national policies and measures for integrating environmental protection and development. New legislation has been adopted to provide a sound and updated legal framework for the pursuit of sustainable development. In a number of small island developing States, comprehensive national strategies have been formulated to provide blueprints for long-term coordinated action. There has also been a growing trend of public participation.

39. There is, however, a continuing need for strong action in this area because small island developing States remain constrained by limited financial, human and technical resources. Some have very limited capacity, even for handling inter-agency coordination. Planning to enforce new legislation and to implement sustainable development measures and implementation of sustainable development policies and measures remain uncoordinated, and are invariably fragmented. There is much room for improving inter-ministerial coordination at the national level and more effective cooperation at the regional level.

B. Recommendations for action

1. National level

40. Small island developing States Governments should further strengthen their national sustainable development bodies by enhancing their political and legal status, increasing their staffing levels and improving their modalities of operation. Those that have not established such a body should take immediate action to ensure that a national mechanism for guiding and coordinating sustainable development policy be put in place and given adequate status and resources for effective functioning.

41. Although many small island developing States have adopted new legislation and formulated national strategies, they need to ensure that the new laws are enforced and strategies are implemented. Particular attention should be paid to the training of civil servants to adequate levels in order to enable them to effectively implement reformed legislation and revised development strategies.

2. Regional level

42. Small island developing States Governments should both expand and deepen their regional and subregional cooperation in national institutions and administrative capacity-building, especially in areas where they are lacking in expertise and where joint activities in research and training could help to overcome national resource constraints, facilitate the exchange of national experience and increase the cost-effectiveness of regional cooperation.

43. Regional institutions should be given adequate resources to provide research and training opportunities, undertake critical assessments of priorities and needs, and facilitate the exchange of experience and the dissemination of information. Regional institutions that have the appropriate expertise should assist small island developing States in the preparation of new legislation, as necessary, and in the formulation and implementation of national strategies.

3. International level

44. The international community should provide adequate financial resources to small island developing States so as to enable them to carry out necessary institutional reforms and changes, and to improve their national administrative capacity. The United Nations agencies should increase training activities to help to update and improve the skills of staff engaged in sustainable development activities. Organizations with the appropriate technical capacity, including United Nations funds and programmes and specialized agencies, should also provide technical assistance or advisory services to small island developing States in building up their national institutions.

45. Bilateral donors should provide financial and technical support to small island developing States to facilitate their ratification and implementation of relevant international instruments; help to provide training opportunities and facilities, including scholarships, particularly in areas where small island developing States suffer from serious lack of local expertise; and support current efforts to build an information network for small island developing States so that they may have better access to information on state-of-the-art technology, and become active participants in the exchange of experience and the dissemination of information.

VIII. Regional institutions and technical cooperation

A. Major additional findings

46. Governments of small island developing States in the Pacific and the Caribbean have put in place a number of regional and subregional intergovernmental institutions, with mandates ranging from specific areas of the Programme of Action to the entire Programme of Action. In recent years, they have also demonstrated their commitment to regional institutions through increased financial support for some of them.

47. Regional institutions have taken a keen interest in the implementation of the Programme of Action. In the recent past, regional institutions in the Pacific and some in the Caribbean have also taken measures to enhance their own effectiveness and efficiency through greater inter-institutional coordination and the avoidance of duplication of activities.

48. However, regional and subregional institutions have faced a number of constraints that tend to undermine their effectiveness. The major constraints are related to insufficiency of financial and human resources to carry out core programmes. They are also hampered by the lack of firmly established regional coordination mechanisms, particularly in the Caribbean and the African regions, as well as the inadequacy of integration of environmental dimensions in the socio-economic planning process at the national level, which makes it difficult to identify priorities for the development of coherent regional and subregional programmes.

B. Recommendations for action

1. National level

49. To strengthen regional cooperation, it will be necessary for small island developing States to explicitly integrate environmental dimensions in the long-term policy planning process at the national level and to identify priority areas for regional implementation in order to enable the development of coherent regional and subregional programmes.

50. In the recent past, small island developing States that are member States of some regional institutions have increased their financial support for the running of such institutions. Such support needs to be further strengthened

so as to make it commensurate with the needs of all regional and subregional institutions in order to raise their effectiveness.

51. In some small island developing States regions, there is a need for greater political commitment to the implementation of regional programmes.

2. Regional level

52. Efforts to strengthen coordination among regional and subregional institutions have begun in the Pacific. Such efforts are needed in all small island developing States regions. For effective coordination of the implementation of the Programme of Action, there is a need to establish permanent regional coordination mechanisms and to provide them with resources commensurate with their needs.

53. Regional institutions need to make efforts to strengthen their own technical capacity in order to meet technical assistance needs of member States.

54. Regional and subregional institutions need to work more closely with national Governments to identify programmes and projects for the development of realistic regional and subregional programmes in the short and medium terms.

3. International level

55. In view of the obvious benefits to be derived from regional cooperation, the international community needs to adequately supplement the financial resources provided by member States for the support of regional institutions.

56. In order to enable regional institutions to effectively meet the technical assistance needs of member States, there is a need for the international community to assist regional institutions in building their technical capacity to levels that are commensurate with the needs of member States.

57. Although the prime responsibility for the execution of regional programmes and projects rests with small island developing States Governments, in view of the meagre resources of individual small island developing States and the high costs of regional programmes, there is an obvious need for adequate financial support from the international community for timely and effective implementation of regional programmes.

58. Relevant United Nations regional commissions and other United Nations organizations need to demonstrate a greater level of engagement in the implementation of the Programme of Action, particularly in the African region.

IX. Science and technology

A. Major additional findings

59. In spite of considerable efforts by several of them, most small island developing States lack a critical mass of qualified scientists and associated institutions. Current reward systems in island countries do not encourage long-term careers in science, and the availability of funds for training and research in specialized fields of science is limited. Brain drain adds to the scarcity of skills and expertise in relation to the advance of science in small island developing States. This is evident in the high proportion of expatriate personnel in island institutions, and in aid programmes heavily weighted towards technical assistance.

60. Most small island developing States do not possess economies of a sufficient scale to allow for a national scientific infrastructure of the scope required to address many national needs. One solution to this problem is for countries to cooperate at subregional or regional levels to share institutions of higher learning and advanced research and development facilities. Pooling the resources of countries with similar problems, agreeing on common programmes and building synergies are evidently more cost-effective than developing national institutions. Given the serious lack of resources and qualified personnel in small island developing States, a realistic short-to-medium-term strategy for building scientific and technological capacity to manage the effective transition to sustainable development would be to concentrate on subregional measures, wherever feasible. Subregions usually tend to share several common characteristics that facilitate a more rational and efficient use of resources, including qualified staff. Subregional efforts also have greater potential for creating local capacity in the short to medium term than regional (continental) and international programmes. Frequent contacts between scientists from small island developing States and industrialized and relatively advanced developing countries would serve as an efficient modality for rapidly disseminating and applying new scientific and technological methods. At relatively low cost, much can be achieved in practical terms through funds for scientific visits and meetings, electronic communication, access to data banks and so on.

B. Recommendations for action: science

1. National level

61. Intensive and appropriate use of science and technology in small island developing States is essential for attaining sustainable development goals. Governments of small island developing States are encouraged to:

(a) Make greater efforts to improve science education in all phases of formal and informal education;

(b) Establish a network of scientists to work in schools and the public and private sectors;

(c) Undertake national or regional assessments of needs for the capacity in science;

(d) Promote strong linkages between universities and research institutions, on the one hand, and national industries, agriculture and other economic sectors on the other hand, so that scientific knowledge and information finds its way into the productive sectors, and make every effort to induce the private sector of national economies to invest more in the development of science;

(e) Take steps to record and apply indigenous knowledge in promoting participatory approaches to natural resources management and to the equitable and sustainable use of resources.

2. Regional and international levels

62. Relevant regional organizations and international organizations, with donor assistance, could collaborate in assisting small island developing States in:

(a) Implementing programmes to improve the teaching of basic science within the context of the local environment and culture. In Pacific small island developing States, use could be made of the regional Science Education for Pacific Schools programme;

(b) Better educating current and future leaders of civil society on key scientific issues affecting a sustainable future, through schools, youth work and community awareness activities.

C. Recommendations for action: technology

1. National level

63. The Governments of small island developing States are encouraged to:

(a) Provide incentives to venture capital and explore other modalities for meeting the required financing needs of environmentally sound technology firms;

(b) Provide fiscal and other policy incentives to encourage domestic and foreign investment in the industrial sector, and consider special incentives for environmentally sound technology-related investments.

2. Regional level

64. At the regional level, it is necessary to:

(a) Promote the establishment of appropriate regional institutions for the collection and synthesis of data and information on innovative industrial technologies for the sustainable development of small island developing States and on the impacts of industrial innovation on their economies, including their marine and coastal systems;

(b) Develop regional mechanisms to further promote ventures for financing new technology-based firms;

(c) Assist small island developing States with very small populations in (I) better applying science and technology to sustainable development at the community level through participatory projects, (ii) sharing information on best practices and successful methods.

3. International level

65. The international community is urged to:

(a) Enhance international cooperation in the development and promotion of technological innovations relevant for small island developing States as components of international or regional investment projects;

(b) Provide improved access to financial and technical resources to assist small island developing States in establishing regional centres for capacity-building, including training in the management of innovative technologies, technology negotiations and transfer.

X. Human resource development

A. Major additional findings

66. Small island developing States Governments, regional organizations and the United Nations system have accorded priority to this area, as reflected in the initiatives by small island developing States and support action by both regional organizations and the United Nations system. However, the unique demographic, economic and geographic constraints

faced by small island developing States call for a strengthening of the concerted efforts at human resource development. The recent declines in external resources allocated to human resource development in small island developing States are a cause of grave concern.

67. Policy initiatives by some small island developing States Governments in the areas of institution-building, educational reform, training and regional cooperation in environmental management provide useful experiences, and should be shared with others in their efforts to formulate and implement human resource development strategies.

B. Recommendations for action

68. It is strongly recommended that small island developing States Governments continue to accord priority to human resource development in all its dimensions – human health care, basic education, environmental education, training and resource management in specific fields.

69. Given demographic, economic and geographic constraints, small island developing States should consider a well educated, highly adaptable and environmentally conscious population and workforce to be a central pillar of national sustainable development. Small island developing States Governments should create conditions, including through regional mechanisms, to retain newly acquired or updated endogenous expertise.

70. Small island developing States should further strengthen regional cooperation through pooling of resources and expertise, increase the effectiveness of such cooperation through systematic identification of needs and planning of projects, and increase the efficiency of regional resource use through better coordination.

71. Regional organizations and the United Nations system should strengthen their support to small island developing States. In particular, the organizations and bodies of the United Nations system should increase their operational activities to provide training and expertise to small island developing States in integrated resource management. Areas where local capacity is relatively insignificant should be accorded priority in funding and provision of technical assistance.

72. The declines in external resources provided to small island developing States for human resource development should be reversed as a matter of urgency. In this regard, the envisaged meeting between representatives of small island developing States and bilateral and multilateral donors provides a great opportunity for taking concrete actions.